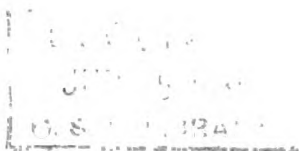


DEPARTMENT OF COMMERCE
UNITED STATES BUREAU OF MINES
SCOTT TURNER, DIRECTOR

INFORMATION CIRCULAR

GEOPHYSICAL ABSTRACTS

NO. XXV



BY

FREDERICK W. LEE

INFORMATION CIRCULAR

DEPARTMENT OF COMMERCE -- BUREAU OF MINES

GEOPHYSICAL ABSTRACTS¹

No. 25

Compiled by Frederick W. Lee²

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1. GRAVITATIONAL METHODS

(162) CONTRIBUTION TO THE QUESTION OF THE DISPLACEMENT OF THE ZERO POINT OF THE TORSION BALANCE IN A GRAVITY VARIOMETER (IN RUSSIAN)

By D. G. Uspenski

Transactions of the Institute of Applied Geophysics, Leningrad, U.S.S.R.,
vol. 6, 1930, pp. 3-10.

In this article the author gives the results of the tests carried out in the Gravimetrical Laboratory of the Institute of Applied Geophysics concerning the temperature effects upon the displacements of the beams of a gravity variometer.

The tests were performed under conditions similar to those described in the previous work of the author published under the same title (see Geophys. Abs. No. 9, p. 5). By working with instruments devised by the Institute of Practical Geophysics, the state of equilibrium of the beam can be established by measuring the damping sinusoids registered by the beam.

The results of the tests are considered to be successful.—W. Ayvazoglou.

(163) OBSERVATIONS WITH GRAVITY VARIOMETERS AT THE SLAVIANSK SALT DEPOSITS IN 1928-29 (IN RUSSIAN)

By D. G. Uspenski

Transactions of the Institute of Applied Geophysics, Leningrad, U.S.S.R.,
vol. 6, 1930, pp. 11-27.

These observations were carried out in the winter of 1928-29.

Contents of the article:

1. Instruments and accessories.
2. Observations with gravity variometers.
3. Efficiency of the instruments and analysis of failures.
4. Shift of the zero point and accuracy of instruments.

Two gravity variometers constructed by the Seismological Institute, Academy of Sciences, and by the Institute of Applied Geophysics (Type 1928, Nos. 239 and 240) were used.

The author gives a series of tables in which the work of Russian instruments is compared with Schweydar-Bamberg's model and Hecker's large model (the data for the latter two being taken from the observations made in Krivoy Rog in 1927).

In conclusion the writer says that, based on the comparative data given, the Russian instruments of the 1928 type must be considered more suitable than Bamberg's and Hecker's instruments, as they have shown higher efficiency in spite of more difficult conditions of work.--W. Ayvazoglou.

(164) THE QUANTITY $\frac{\partial g}{\partial z}$ AND ITS ROLE IN GEOPHYSICS

By M. A. Sadovsky

Transactions of the Institute of Applied Geophysics, Leningrad, U.S.S.R.,
vol. 6, 1930, pp. 28-47.

This paper deals with the possibility of measuring the quantity $\frac{\partial g}{\partial z}$ the anomalous gradient of gravity tension along the vertical, and of applying the said gradient to the solution of problems concerning mass distribution in the upper layers of the earth crust. It has not been so far possible to determine this quantity with a sufficient accuracy, although the knowledge of it would be of a very great help for the solution of many practical as well as theoretical problems.

The following principal cases in which the quantity $\frac{\partial g}{\partial z}$ could be applied are mentioned:

1. Reduction of pendulum observation.
2. The solution of the problem on the structure of the upper layers.
3. The definition of the mean density of the earth and of the shape of the geoid.

From the mathematical calculations given in this article the author concludes that the technical realization of such an instrument is impossible. Moreover, such an apparatus would probably possess numerous defects which would considerably reduce the range of its application.--W. Ayvazoglou.

(165) A BRIEF ACCOUNT OF THE RESULTS OF GRAVIMETRICAL PROSPECTING
AT THE PRIMARY PLATINUM DEPOSITS IN THE DISTRICT OF NIJNI-TAGIL

By P. M. Nikiforov and S. K. Ghirin

Transactions of the Institute of Applied Geophysics, Leningrad, U.S.S.R.,
vol. 6, 1930, pp. 48-58.

The purpose of the investigation described in this article may be summed up as follows:

1. To establish the outlines of the platinum-bearing dunite massif among the rocks surrounding it.
2. To determine the thickness and the position of the massif.
3. To isolate the parts of the dunite massif containing chromite as the latter forms the main primary platinum deposits.

Observations were made with instruments constructed in the workshops of the Seismological Institute of the Academy of Sciences. Two hundred and seventeen observations were taken.

This paper deals with the characteristics of physical values obtained and contains, besides, some conclusions drawn from the study of the whole material.

The anomalous gradient values of the force of gravity are shown on the annexed diagrams.

The authors conclude that their attempt to study the geological problem by gravimetrical method has yielded good results and all the questions, in spite sometimes of schematical solutions given, have been answered. The work will be continued in order to clear up the points of the problem not sufficiently disclosed.—W. Ayvazoglou.

2. MAGNETIC METHODS

(166) REMANENTER MAGNETISMUS UND GESTEINSFLUIDITÄT

(REMANENT MAGNETISM AND THE MAGNETIC FLUX OF ROCKS)

By J. Koenigsberger

Zeitschrift fuer Praktische Geologie, Halle,
vol. 39, No. 2, 1931, pp. 26-27.

In this article the author gives a comparison of the results of experiments carried out by different methods on the determination of the susceptibility and the remanent magnetism of rocks. The methods discussed are those used by K. Puzicha, G. Grenet, and J. Koenigsberger (see Geophys. Abs. Nos. 22, p. 4; 20, p. 5; and 18, p. 4, respectively).

Taking into consideration the fact that samples of rocks taken from the same quarry often display differences in susceptibility, the remanence and the ratio of the remanent magnetism to the induced magnetism amounting sometimes to 100 per cent, the author says that the purpose of his investigation does not concern the accuracy of the methods applied but merely the question of the possibility of quick measurements without making systematic errors.—W. Ayvazoglou.

(167) DIE MAGNETISCHEN GRANITE VON SCHIERKE IM HARZ

(THE MAGNETIC GRANITES OF SCHIERKE IN THE HARZ)

By Kurt Puzicha

Centralblatt fuer Mineralogie, Geologie und Paläontologie, Stuttgart,
Abt. B., No. 1, 1931, pp. 1-6.

The displaying by rock layers of self-magnetism produced by lightning strokes, in addition to their magnetization by the influence of the earth's

field, may sometimes be the cause of incorrect conclusions on magnetic anomalies in certain regions, as determined by magnetic surveys.

In order to find out to what extent the magnetic anomaly observed in the region of the granites of Schierke may be influenced by this self-magnetization of the granites the author carried out laboratory investigations of eight samples taken from the border zone of the Brocken-massif and proved that the susceptibilities of these granites were sufficiently high to cause the magnetic anomalies established by Reich.

The results of investigations are described in this article and illustrated by two diagrams. Numerical data are given in a table.--W. Ayvazoglou.

(168) ATMOSPHERIC PRESSURE AND THE STATE OF THE EARTH'S MAGNETISM

By J. M. Stagg

Nature, London, vol. 127, No. 3202, 1931, p. 402.

The author discussed the obtained results pointing to a hitherto unsuspected relation between the type of the diurnal variation of pressure and the general state of magnetic conditions, as regards disturbance and quiet over the earth.

Mean diurnal inequalities of pressure corrected for nonperiodic change were computed for the two sets of days, magnetically quiet and magnetically disturbed, on the basis of the five days of each type per month over the seven years, 1922-1928. By grouping the inequalities according to the season of the year, diurnal variations of pressure were constructed. A further rearrangement of the data gave inequalities illustrating the pressure variations on the two types of days in years of low and high solar activity.

The results are shown in the six pairs of curves, one of which represents the diurnal variation of pressure on magnetically quiet days and the other on magnetically disturbed days. The difference in form of the curves shows the change in the pressure variation from one type of magnetic days to the other.

From these it is clear that in all but the last pair the predominant features of the change are the reduced development of the forenoon maximum and enhancement of the evening maximum on disturbed as compared with quiet days.--W. Ayvazoglou.

3. SEISMIC METHODS

(169) SEISMIC METHODS OF PROSPECTING AS APPLIED IN MINING. (IN RUSSIAN)

By Dr. Heise

Gorny Journal. (Mining Journal), Moscow,
vol. 106, No. 6-7, pp. 163-166.

After a brief description of the principles of seismic methods of prospecting Heise mentions the great success obtained by this method in prospecting for oil in America, especially in Texas and Louisiana. A map showing, for comparison, the salt domes discovered in these States by geophysical methods, and those known before the introduction of these methods is given.

The possibility of determination by the seismic method of anticlines, faults and similar irregular dislocations of rock masses makes the application of this method in mining important. In a figure the author gives the contour lines of the region of coal deposit in the Government mines of Hendrik, near Heerlen in Holland, as established by the seismic survey. The survey shows that the relief of the surface of the coal deposit is not as level as could be expected on the basis of the results obtained by drilling a few holes.—W. Ayvazoglou.

(170) BEITRAG ZUR BERECHNUNG VON KONSTANTEN DER GALITZIN'SCHEN
APERIODISCHEN SEISMOGRAPHEN(CONTRIBUTION TO THE CALCULATION OF CONSTANTS OF
GALITZIN'S APERIODIC SEISMOGRAPHS)

By E. Buss

Académie des sciences de l'U.R.S.S., Leningrad, Publication
de l'institut séismologique, No. 8, 1930, pp. 1-11

Formulas are derived for working out special tables which may serve for finding the accurate values of the constants during the observations without considerable calculations, so that the necessary adjustments may be made without delay. The tables are added to the article.—W. Ayvazoglou.

(171) SEISMOLOGY AND ENGINEERING

By N. H. Heck

The Military Engineer, Washington, D. C.,
vol. 23, No. 128, 1931, pp. 131-134.

The effect of artificial earthquakes produced by means of large explosions and the outline of the fundamental facts regarding earthquakes, as well as the progress that has been made in understanding them are briefly discussed.

The principles of the construction of seismographs are described and typical seismograms and photographs of various seismographs are given.

The greatest importance of earthquakes from the engineering viewpoint with regard to the visible effects on the earth's surface may include: fracture along a fault plane with horizontal or vertical slipping along a vertical plane; slipping along an inclined plane; wholesale raising of an area; wholesale lowering over a large area; and movement of large blocks, either tilting or raising or lowering.

Thus the effects on structures are very complex.

The study of these effects artificially produced by vibrating platforms (Stanford University) for obtaining valuable information is mentioned.

The author concludes the article by enumerating the organizations working on the general problems connected with seismological research.--W. Ayvazoglou.

4. ELECTRICAL METHODS

(172) CALCULATION OF THE POSITION OF THE REFLECTING SURFACE ACCORDING TO OBSERVATIONS MADE BY MEANS OF THE RETURN METHOD (IN RUSSIAN)

By A. Petrowsky

Transactions of the Institute of Practical Geophysics, Leningrad, U.S.S.R.,
vol. 5, 1930, pp. 3-27.

This paper is a continuation of Petrowsky's article, "Theory of the return method" (see Geophys. Abs. No. 1), and is based on the formulas deduced in it. The purpose of this article is to find practical methods by means of which it would be possible to answer the following questions:

1. How is the reflecting surface situated with regard to the vibrator sending the waves?
2. At what distance from the center of the vibrator is this surface situated?

To answer the first question it is necessary to make a series of observations of the generation under different positions of the vibrator, that is, under different angles of inclination of the axis of the vibrator to the reflecting surface. The study of these waves makes it possible to determine the direction in which the vibrator is perpendicular, as well as the directions in which the vibrator is parallel to the reflecting surface.

The answer to the second question may be obtained from the same generation curves but also in the following way: The vibrator can be given a certain definite position--for example, parallel to the reflecting surface--and then generation curves of different lengths of waves may be drawn.

Mathematical details, the knowledge of which is necessary for a correct calculation of the results, are given.

Diagrams and tables complete the article.--W. Ayvazoglou.

(173) BASES FOR THE CALCULATION OF THE EQUIPMENT REQUIRED FOR
ELECTROMETRICAL PROSPECTING (IN RUSSIAN)

By A. Petrowsky

Transactions of the Institute of Practical Geophysics, U.S.S.R., Leningrad,
vol. 5, 1930, pp. 28-41.

The author makes an attempt to utilize the results of theoretical works on electrical prospecting for the determination of conditions under which the equipment necessary for this prospecting could be used with the greatest advantage, avoiding all unproductive expenses.

All the calculations are made with regard to a deposit having a spherical shape. The author applies formulas deduced by him in his previous articles: "Natural Electric Field Produced by Ore," and "Determination of the Location, Depth and Thickness of a Spherical Ore Body by Observing the Earth Current Produced" (see Geophys. Abs. No. 1, pp. 13 and 14).

The following questions are discussed:

1. The choice of the dimensions of the field explored and the thickness at the points of observation. The longitudinal dimension of the field must be not less than four times the depth of the center of the spherical ore body and the thickness at the points of observation not less than two-tenths of this depth. Transversal dimensions in the case of a spherical form of the ore body must be equal to the longitudinal ones, thus the application of a square field with 21 points in both longitudinal and transversal directions is most reasonable.

2. Two kinds of prospecting: The experimental--intended only to discover the presence of the ore body; and the detailed--to find the position of the ore body and the other elements characterizing it.

Mathematical calculations for the determination of the magnitude of the deposit by observations made on the natural electric field and calculations on the current strength, intensity and power of the equipment necessary for the observations upon the artificial electric field are given.

The author draws the conclusion that the difficulties of electrometrical prospecting increase quickly with the depth of the ore body, therefore there is no reason to rely upon this method in case of very great depth--

for example, depths reaching a few kilometers. The calculations are applied to an example given at the end of the article.--W. Ayvazoglou.

(174) CALCULATION OF THE GALVANOMETRIC SET FOR THE
MEASUREMENT OF THE GRADIENT (IN RUSSIAN)

By A. Petrowsky

Transactions of the Institute of Practical Geophysics, Leningrad, U.S.S.R.,
vol. 5, 1930, pp. 42-44.

As basis for the calculations given in this article the theoretical formulas derived by the author in his articles: "Theory of the measurements of earth currents" and "Bases for calculating the observations of earth currents" (see Geophys. Abs. Nos. 1 and 2) are used. Calculation of the sensitiveness of a galvanometer under which it becomes unsuitable for the work is the purpose of this article. Petrowsky concludes that: "For the work on a damp ground ($\rho = 10^4 \Omega \text{ cm}^2/\text{cm}$) it is necessary to use a galvanometer with the sensitiveness equal to $0.4/\mu \text{ A}$, while on a dry ground ($\rho = 10^5 \Omega \text{ cm}^2/\text{cm}$) this sensitiveness must be equal to $0.04/\mu \text{ A}$."--W. Ayvazoglou.

(175) ONDOMETRICAL WORK CARRIED OUT IN THE INSTITUTE OF
PRACTICAL GEOPHYSICS (IN RUSSIAN)

By A. Petrowsky, R. Skariatin, A. Seleznev, B. Dostovalov and L. Kleiman

Transactions of the Institute of Practical Geophysics, Leningrad,
U.S.S.R., vol. 5, 1930, pp. 45-69.

The beginning of the ondometrical work (i.e. the application of electromagnetic waves to ore prospecting) took place in 1923. During that year and the following the first portable frame transmitter of small power, intended for ore prospecting, which worked according to Meissner's scheme, was constructed in collaboration with the Leningrad Electrotechnical Experimental Laboratory (figures of the apparatus are given).

The experiments with this transmitter, which had been carried out in the Ilezk salt mines during the summer of 1925, proved the possibility of radio connection through the salt at small distances (about 100 to 150 meters) by means of a pair of such sets.

The experience obtained resulted in the construction of a new transmitter which was tried out in the Ilezk salt mines during the summer of 1927.

In 1928 there was constructed a new receiver (shown in two figures). An expedition to the Tchiraghi-Dzor mines, Caucasus, was equipped with these instruments. The aim of the expedition was to find out the possibility of transmitting the signals through the quartz rocks and the application of the shadow-method to the discovery of the pyrite bodies. The work was carried out as follows: The sender was placed within a drift and the receiver was moved from point to point on the day-surface.

The intensity of the signals received was read at every point by means of a galvanometer. Experiments were made also, with the receiver placed inside of the drift and the transmitter on the day-surface.

The following results were obtained from these experiments:

1. The possibility of the radio transmission of electromagnetic waves, 50 to 250 meters in length, through quartz rocks must be considered to be proved definitely.
2. Radio transmission took place in both direct as well as inverse directions.
3. An ore body (pyrite) placed behind the sender had no marked influence upon the radio transmission.
4. An ore body (pyrite) placed in the path of the electromagnetic waves produced an electromagnetic shadow.

During the tests the authors established the influence of the length of the wave upon the intensity of the signals. In several cases a clear minimum was observed; the reason for this minimum could not be established but it was curious that the length of the wave to which this minimum corresponded was almost equal to four times the average height of the trees surrounding the drift in which the transmitter was operated.

Thirty figures illustrate the article.--W. Ayvazoglou.

(176) A NEW DEVELOPMENT IN ELECTRICAL PROSPECTING

By Hans Lundberg and Theodor Zuschlag

The American Institute of Mining and Metallurgical Engineers, New York.
Technical Publication 415, 1931, 18 pp.

A new measuring procedure permitting potential drop ratio determinations is described. After a brief description of the classification of electrical methods into qualitative and quantitative ones, and the further subdivision of the latter into potential drop and potential ratio techniques, the authors point out the advantages which would accrue from the elimination of certain deficiencies in potential ratio studies. These deficiencies are due to the existence of unknown and variable contact resistances at the earth connections. These contact resistances may be eliminated by a mathematical procedure which was made the basis of the design of the potential drop ratio compensator called the "Racom," developed by Zuschlag.

Generally speaking, the Racom is a sensitive bridge arrangement for the accurate and speedy execution of potential drop ratio determinations, and is thus adapted to geoelectrical exploration. The principles of its operation and use are described with reference to a series of figures. The results of four actual investigations, including ore hunting, determining the depth of water and of bed rock and depicting the underlying geological columns at various stations of interest to the oil geologist are discussed.--W. Ayvazoglou.

(177) HUNDERT JAHRE ELEKTRISCHE BODENFORSCHUNG

(ONE HUNDRED YEARS OF ELECTRICAL PROSPECTING FOR ORE)

By B. Duschnitz

Kali, Berlin, vol. 25, Nos. 5 and 6, 1931, pp. 71-76 and 88-92.

Duschnitz gives an interesting sketch of the development of the electrical methods of prospecting since 1830. Beginning with the first experiment carried out by Robert W. Fox (Philosophical Transactions, 1830, pp. 399-414), and after having mentioned the names of a series of other investigators, the author gives a more detailed description of prospecting for ore carried out by electrical waves according to Trustedt (1901).

The methods originated by Lowy and Leimbach, called by them: (1) The reflection method; (2) the absorption method; (3) the capacity method; (4) the interference method; and (5) the method of quarter waves (Viertelwellenmethode) are discussed, their application at different places is described and conclusions are drawn.

All the electrical methods of prospecting are divided by the author into three main groups:

1. Prospecting by means of Hertzian waves.
2. Prospecting by means of natural earth-currents.
3. Prospecting by means of artificial currents produced in the ground.

Although all the three groups supplement one another, the third group is considered the most important one, as these methods make possible the obtaining of a graphic picture of the area under investigation.

The application of the electrical methods of prospecting by Schlumberger, Ambronn, Heine, Krahmann and many others is mentioned.

A long list of literature is added.--W. Ayvazoglou.

(178) A THEORETICAL STUDY OF APPARENT RESISTIVITY

By J. N. Hummel

American Institute of Mining and Metallurgical Engineers, New York,
Technical Publication 31, 1931, pp.

A number of surface potential methods and the relation of potential distribution to subsurface resistivity are discussed. The principal field of application of these methods is the investigation of strata with horizontal (or nearly horizontal) bedding planes. Absolute potential differences are measured along a line at the surface. Of all possible arrangements of electrodes, five are listed which are most suitable from the standpoint of

field procedure and clearness of interpretation. From the potential differences, the subsoil resistivity, termed "apparent resistivity," may be computed. It changes with the distance between the secondary electrodes and is also a function of the resistivities of the surface formations as well.

The cases of a spherical mass, a 2-layer problem, and a 3-layer problem, are analyzed. In the layer problems, the author makes use of the theory of images.

From the potential, the expression for the apparent resistivity is derived as a function of the distance between the secondary electrodes. Several curves are given for different ratios of resistivity. In the 3-layer problem, an approximative curve is computed which approaches the true curve for large distances, and the true curve can be found by graphical interpolation. This procedure greatly simplifies the mathematical analysis.—Abstract from Mining and Metallurgy, vol. 12, No. 292, 1931.

(179) ELECTROMAGNETIC ABSORPTION BY ROCKS WITH SOME EXPERIMENTAL
OBSERVATIONS TAKEN AT THE MAMMOTH CAVE OF KENTUCKY

By J. Wallace Joyce

U. S. Department of Commerce, Bureau of Mines,
Technical Paper 497, 1931, 28 pp.

This paper endeavors to shed some light on the question of the penetration of electromagnetic fields or waves into the ground. It is intended to settle definitely the fact that such waves penetrate the earth's surface and that, in so doing, absorption occurs. The question is vital to geophysics, since the successful operation of all induction methods depends upon this factor.

Contents of the article:

1. Fundamental principles of induction methods.
2. Factors influencing reaction of conducting bodies.
3. Absorption formulas (Maxwell's, Zenneck's, King's and Sommerfeld's absorption formulas).
4. Comparison of absorption formulas.
5. Theory of method of experimental measurement of absorption.
6. Formulas for calculation of coefficient of mutual inductance between two circular loops with planes parallel and not in the same plane.
7. Experimental work (early work, site of work, preliminary tests, qualitative work, quantitative work, procedure, experimental results).
8. Discussion of results.

In conclusion the author says that the fact that electromagnetic waves actually penetrate rock has been definitely established. A start has been now made toward the quantitative verification of absorption formulae, and with the material contained in this paper as a foundation, additional experimental facts will be obtained in the near future which will no doubt provide a great additional amount of valuable information.

The results of this investigation show that a frequency of 500 cycles per second is well suited for electromagnetic prospecting. Absorption, although present, does not materially limit the applicability of this method.

--W. Ayvazoglou.

(180) EARTH-RESISTIVITY MEASUREMENTS IN THE COPPER COUNTRY, MICHIGAN

By W. J. Rooney

Terrestrial Magnetism and Atmospheric Electricity, Baltimore, Md.,
vol. 32, No. 3/4, 1927, pp. 97-126.

During the summer of 1927 the Department of Terrestrial Magnetism of the Carnegie Institution and the Michigan College of Mines and Technology jointly conducted a series of earth-resistivity measurements in the copper country of northern Michigan, where the geological structure is well known, to determine the value of measurements of resistivity and its variations as indications of the geological structure below the surface. The work done may be roughly divided in two parts: First, measurement and study of the variations in resistivity with depth, or with volume, to establish such general relations as exist between the two; and, second, the determination of the resistivity of specific rock-flows, in order that more fundamental data be made available as an aid to the interpretation of the results of the former type of measurement.

The results of the first part of the investigation bear out the evidence from previous work that resistivity-determinations may be used to advantage in determining the location of certain underground discontinuities. The data obtained in the second part on the resistivity of specific rocks are also in line with previous results. The resistivity of porous, sedimentary rocks was usually under 20,000 ohms per centimeter cube, while traps and associated rocks of volcanic origin were found to have resistivities from five to twenty times as great.--Author's abstract.

5. RADIOACTIVE METHODS

(181) A MORE ACCURATE AND MORE EXTENDED COSMIC-RAY IONIZATION-DEPTH CURVE, AND THE PRESENT EVIDENCE FOR ATOM-BUILDING

By Robert A. Millikan and G. Harvey Cameron

The Physical Review, Minneapolis, Minn.,
vol. 37, No. 3, 1931, pp. 235-252.

The cosmic-ray ionization-depth curve has been extended at both its upper and lower ends and made more accurate throughout. The absorption

coefficients obtained directly from the slope of the curve run from $\mu = 0.35$ per meter of water at the top (Pike's Peak) to $\mu = 0.028$ at the bottom (80 meters or 262 feet of water below the top of the atmosphere), thus bringing to light both softer and harder components than the authors had before found. Strong quantitative evidence is presented, on the basis of the Klein-Nishina formula, that the strongest and most absorbable cosmic-ray band arises from the act of formation of helium out of hydrogen. Striking quantitative evidence is found that the three more penetrating bands are due to the formation out of hydrogen of the only other abundant elements oxygen (C, N, O) silicon (Mg, Al, Si, S) and iron (iron group). Two independent proofs are given that the cosmic-rays enter the earth's atmosphere as photons; namely, (1) they are quite uninfluenced by the earth's magnetic field, and (2) the ionization produced by them in a closed vessel does not increase continually in going to the top of the atmosphere, but passes through a maximum. It is shown to follow that the cosmic rays, in coming from their place of origin to the earth have not passed through an amount of matter that is appreciable in comparison with the thickness of the earth's atmosphere and that they must therefore originate in interstellar space rather than in the atmospheres of the stars. Some participation of the nucleus in the absorption of cosmic rays is brought to light.--Authors' abstract.

(182) ZUR METHODIK DER IONENZÄHLUNG IN DER FREIEN ATMOSPHERE

(CONCERNING THE METHOD OF COUNTING IONS IN THE FREE-AIR)

By Yo Itiwara

Physikalische Zeitschrift, Leipzig, vol. 32, No. 2, 1931, pp. 97-106.

The author points out that if ion tube-counters which are assigned for measuring the total number of all the small and large ions existing in the free air are used according to the method of charging (Auflademethode),--that is, the external electrode of the cylindrical condenser is kept at a constant potential and the charging of the inner electrode, which is connected with the earth, is measured,--not the total number of ions is measured, as has been accepted so far, but only one fraction of it.

The reason for this phenomenon consists of the fact that the charged external electrode produces at the place of the entrance of the ions a field by which a certain fraction of the ions is prevented from entrance into the counting apparatus.

The author proves by an experiment that large ions only are measured by the tube-counter described by A. Gockel and used by V. F. Hess during his measurements in Helgoland. Based on this fact, some results of Hess' measurements are to be corrected in order to obtain better conformity of his results with those procured by J. J. Nolan and his collaborators.--Author's abstract translated by W. Ayvazoglou.

The above article is followed by V. F. Hess's "Remarks concerning Yo Itiwara's work" in which Hess disagrees with some results of measurements obtained by Itiwara and recommends that Itiwara's experiments be repeated in the free air and under a different form.--W. Ayvazoglou.

7. UNCLASSIFIED METHODS

(183) GEOPHYSICAL METHODS WITH SPECIAL REFERENCE TO COAL MINING

By E. Bein and H. Bertram Bateman

The Colliery Guardian, London, vol. 142, No. 3666, 1931, pp. 1182-1183.

In this article the authors point out in a general way the applicability of geophysics to coal mining.

They divide the problems which arise in respect to coal mining into two classes:

1. The direct location of coal seams and their position, thickness, etc.
2. The location of zones of disturbance associated with coal seams.

The applicability of the different geophysical methods is examined from the standpoint of exceptional cases, that is, cases where the circumstances are so favorable that the physical characteristics of a sufficiently thick seam make it definitely distinguishable from the strata above and below.

The following methods are discussed:

Gravimetric Investigations. - The torsion balance can not directly locate a coal deposit, but it can under certain circumstances locate the underlying stratum should the latter be inclined and show a distinct density difference from the overlying stratum. Topographical conditions should be as uniform as possible.

Electric Investigations. - The electrical method is inapplicable, as coal is a mineral which shows great variations of electric conductivity, depending on its composition and water content.

Seismic Investigations. - Exact depth estimates can be given only in cases where the order of the strata is such that the travel time of the elastic waves is always greater in the one stratum than in that overlying it, and less than in that of the underlying stratum. These conditions are sometimes found in brown-coal fields. Therefore, only in exceptional cases can the seismic method elucidate problems concerning the actual coal seam. Good results can be produced where it is a question of reaching the floor of the bed. Should the coal seam crop out, then there is every possibility of locating its strike, and even perhaps of determining its depth.

Geothermic Measurements. - Geothermic measurements can often be of great value and should be carried out systematically as drilling progresses.

Magnetic and Radioactive Methods. - There can be no question of using magnetic and radioactive methods for the direct investigation of coal deposits, as the physical conditions necessary for the application thereof do not exist.

Of particular importance are zones of disturbance causing (1) displacement, and (2) decomposition of seams.

To the first class belong faults and thrust faults; to the second belong such occurrences of eruptive rocks, principally basalt and dolerite, as appear in some English coal fields, intrusions, sheets, etc.

It is quite certain that more may be expected from geophysics as a means of solving such problems than as a means of directly locating coal seams.

--W. Ayvazoglou.

(184) GEOPHYSICAL EXAMINATION OF METEOR CRATER

By J. J. Jakosky, C. H. Wilson and J. W. Daly

The Mining Journal, Phoenix, Ariz., vol. 14, No. 22, 1931.

Of the various theories advanced regarding the origin of Meteor Crater, two have been considered as most probable:

1. That the crater was formed by a meteorite or a swarm of meteoric material.
2. That it was formed by a "steam explosion" from hot solutions of gases.

The general purpose of the present geophysical work was to obtain information regarding the origin of the crater, and also as to the advisability of continuing with the exploration, and in particular where such exploration efforts should be directed.

Three main independent studies were carried out:

1. Geological. - The geology of Meteor Crater stratigraphy, its structure, conclusions on which the meteoric origin of the crater is based, as well as geologic age of Meteor Crater are discussed.
2. Electrical. - Factors governing electrical methods, apparatus used and general theory, plans of the electrical survey, and general summary of electrical work are examined.
3. Magnetic Investigations. - Theory, external field of meteoric mass, measurements, field procedure, masking effect of the crater-fill, regional gradient, anomalies in the crater, and the summary of the magnetic work are given.

In the "General summary of geophysical-geological results" the authors draw the following conclusions from the correlation of the geological, electrical, and magnetic studies:

1. From a geological examination the authors believe that the crater was formed by impact of a meteorite or a swarm of material.

2. The electrical survey gives indications of the presence of an area of higher conductivity in the southwest quadrant of the crater between the center and the rim. The main mass of this material lies at an effective depth of approximately 750 feet. A careful study of the original and altered materials found in the area indicates that this zone of higher conductivity is not due alone to fill material or structural conditions. The conclusions are that this zone contains meteoric material.

3. The magnetometer survey indicates the presence of an area containing magnetic material in the southern portion of the crater. This material starts at depths of approximately 200 feet and continues downward, probably concentrating with depth.

4. The geological evidence and the electrical and magnetic indications would individually be classed as fair or moderate effects of a buried mass. The general agreement as regards plan, location, depth, and other factors gives sufficient added strength to the results to warrant further explorations to the extent of churn drill holes, in the southwest gradient of the crater.

5. Results of the work are not considered sufficiently definite, in view of complicating factors encountered, to warrant calculations or predictions regarding the tonnage or mass of material which may be present. The chief result of the work has been to delineate definitely the area wherein future development work is to be concentrated.

6. The water level in the crater is comparable with the water level outside of the crater.

Figures of east-west and north-south sections, showing the probable structure of Meteor Crater, are given.—W. Ayvazoglou.

(185) GEOPHYSICAL SURVEYS IN OIL TERRITORIES

By J. B. Ostermeier

Oil News, London, vol. 28, No. 940, 1930, p. 546.

Speaking on geophysical methods of prospecting, the author states that gravimetric surveys in oil territories, particularly where the oil occurs in connection with salt deposits, have already reached considerable proportions by reason of the clear interpretation of the results of measurements allowed by this method. Seismic surveys give their most valuable results when comparative horizontal strata are involved.

These two methods are recommended for use with advantage when large areas have to be covered and if the preliminary work or its continuation is to be undertaken on a large scale and regardless of cost. The other methods discussed are the electrical and magnetic ones.

The possibility of the determination of synclines by geophysical methods and the particular importance of this fact to oil prospecting is mentioned.—W. Ayvazoglou.

(186) GEOPHYSICAL PROSPECTING DISCUSSED BY THE ST. LOUIS SECTION

By H. S. McQueen

Mining and Metallurgy, New York, vol. 12, No. 291, 1931, p. 172.

This paper is the report of a meeting held at the Missouri Athletic Association on January 17, 1931, at which H. A. Buehler, State Geologist, spoke on "The Results of Geophysical Prospecting by the Missouri Geological Survey During the Past Two Seasons."

The Geological Survey carried on field work in two branches of geophysics; namely, magnetometer survey and electric resistivity measurements. The studies have been confined to the iron ore deposits of the Ozark region, the lead deposits of southeast Missouri, and, to a lesser extent, to the high-alumina clay deposits of the north-central Ozark region.

The magnetometer surveys have been successful in outlining the configuration of the pre-Cambrian surface, and particularly the location of pre-Cambrian porphyry "highs" which in some instances bear a definite relation to the location of ore bodies in the adjacent sedimentary rocks. The results have also been applied to the solution of deep well water problems.

The Gish-Rooney method was used in the earth-resistivity measurements. This method of prospecting has been confined chiefly to the sinkhole type deposits of red hematite occurring in the central Ozark region. Detailed work indicates that the general area of the sink can be outlined and information obtained regarding the depth of the structure.

Measurements were also made over sink-hole type deposits containing diaspore clay. The thickness of the overburden and the thickness of the clay check very closely the results of drilling.--W. Ayvazoglou.

(187) THE GEOPHYSICAL DISCUSSIONS

Editorial note

Mining and Metallurgy, New York, vol. 12, No. 291, 1931, pp. 151-153.

This is a brief description of two sessions held by the Committee on Mining and Metallurgy on papers on geophysics. The following papers were discussed:

1. Resistivity Measurements upon Artificial Beds, by J. H. Swartz (see Geophys. Abs. No. 23).
2. Experimental Observations of Electromagnetic Absorption at the Mammoth Cave of Kentucky, a report on the results of work undertaken by J. Wallace Joyce, A. S. Eve, D. A. Keys, and F. W. Lee. Joyce discussed the relative value of various absorption formulas for different frequencies, and pointed out the necessity of applying experimental checks.

3. New development in electrical prospecting, by Hans Lundberg and Theodor Zuschlag (see Geophys. Abs. No. 25).

4. Electrical exploration applied to geological problems in civil engineering, by E. G. Leonardon (see Geophys. Abs. No. 24).

5. Mathematical theory of electrical flow in stratified media, by D. O. Ehrenburg and R. J. Watson (see Geophys. Abs. No. 24).

6. Analysis of some seismic prospecting field data, by L. Don Leet and Maurice Ewing in which they presented some formulas for time distance curves and emphasized the importance of curved paths of seismic impulses.

7. A magnetic method of estimating the height of some buried magnetic bodies, by A. S. Eve (see Geophys. Abs. No. 24).

8. Practical geomagnetic exploration with the Hotchkiss Superdip, by Noel H. Stearn (see Geophys. Abs. No. 19).

9. Method for determining the magnetic susceptibility of core samples, by William M. Barret (see Geophys. Abs. No. 24).

10. Geophysical examination of Meteor Crater, Arizona, by J. J. Jakosky, C. H. Wilson and J. W. Daly (see Geophys. Abs. No. 25).

The meeting was adjourned after a strong request was voiced for more papers dealing with the intricacies of interpretation of the field readings, together with practical illustrations from experience of how conclusions are drawn from the data obtained. These are things that have not been divulged to any extent by commercial companies, who have left it to the Government experimenters to describe these secrets. For the benefit of all concerned, a more open-handed policy might well be adopted.—W. Ayvazoglou.

(188) OPENING OF COASTAL FIELD SHOWS VALUE OF GEOPHYSICS

By Jack Logan

The Oil Weekly, Houston, Tex., vol. 60, No. 8, 1931, p. 74.

The author enumerates a series of geophysically discovered salt-dome prospects in which production has been established with the first well following geophysical work (Sugar Land, Port Neches, and Bloomington fields in Texas, and Port Barre, East Hackberry, Lake Pelto, Bay St. Elaine, Dog Lake, and Cameron Meadows in South Louisiana).

Numerous other fields have come in with the second or third test following geophysical work, among them being Hankamer and Esperson; while there have been many other instances in which dome formation (cap rock or salt) has been established in one, two, or three tests.

Logan concludes by saying: "The fulfillment of the geophysical interpretation is noteworthy."—W. Ayvazoglou.

(189) GEOPHYSICAL PROSPECTING FOR OIL AND GAS

By James C. Templeton

The Petroleum Times, London, vol. 25, No. 630, 1931, pp. 175-176.

In this address delivered before the Oil Industries Club, London, Templeton outlined the most important methods of geophysical prospecting. He expressed the opinion that the gravitational and seismic methods were by far the most important ones, the magnetic method being used in areas where the geological conditions were particularly suitable for that method of investigation, while the different types of electrical methods had only a very limited application in oil prospecting. In connection with electrical methods Templeton made reference to the new development, namely the electrical logging of wells.

The great progress made in the improvement of geophysical instruments and equipment, as well as great advances in the mathematical analysis and the geological and geophysical relationship were discussed.--W. Ayvazoglou.

(190) ÉTUDE DE L'INFLUENCE DE QUELQUES FACTEURS GÉOPHYSIQUES
SUR LES POINTS DE CHUTE DE LA FOUDRE(STUDY OF THE INFLUENCE OF SOME GEOPHYSICAL FACTORS UPON
THE POINTS WHERE LIGHTNING STRIKES)

By L. N. Bogoiavlensky

Laboratoire Radiologique de la Chambre Centrale des Poids et Mesures,
Leningrad, U.S.S.R., 1931, 12 pp.

The author describes his studies on the conductivity of the atmospheric air and of the soil in localities often struck by lightning.

Four different methods were used:

1. Method of radiometric prospection according to penetrating radiation.
2. Measurements of the electrical conductivity of the atmospheric air by Gerdien's apparatus.
3. Method of electrometric prospection by using artificial electric fields.
4. Method of electrometric prospection of natural electric fields.

Conclusive results were obtained from the first three methods; the results have proved that the values of the intensity of terrestrial penetrating radiation, as well as those of the electrical conductivity of the atmospheric air are always higher in places often struck by lightning.

The electrical conductivity of the ground also reaches its maximum at the points with a maximum intensity of penetrating radiation.

The experiments were carried out in two different localities 200 kilometers from Leningrad, the ground of which consisted of sedimentary rocks (clay and sandstone) of the Devonian period covered with deposits in the form of boulders of crystalline rocks of the ice period.

Thirteen diagrams are added to the article.--Author's abstract translated by W. Ayvazoglou.

8. GEOLOGY

(191) SHAPING THE EARTH

By William Bowie

Journal of the Washington Academy of Sciences, Baltimore, Md.,
vol. 21, No. 6, 1931, pp.

In this address delivered before the Academy in January, 1931, Bowie discussed the question of "Shaping the earth" under the following headings: (1) The crust of the earth; (2) formation of oceans and continents; (3) known facts about the earth; (4) isostasy; (5) the figure of the earth; (6) effect of topography on geodetic data; (7) variations of gravity; (8) comparison of Pratt and Airy hypotheses; (9) assumptions underlying isostatic investigations; (10) some isostatic conclusions; (11) isostatic adjustments and earthquakes; (12) objections to the contraction hypothesis; (13) diastrophic forces; (14) erosion and sedimentation; and (15) thermal changes in crust.

In his conclusion Bowie says:

"Isostasy is now widely recognized as a scientific problem. Its advocates hold that there is a maintenance of the isostatic equilibrium as materials are moved from one place to another over the earth's surface. These are the physical facts which are related to the processes involved in changes in the earth's surface. They have been proven by actual physical measurements. It has been stated that there are great horizontal movements in mountain areas, but that isostasy and its maintenance call for only vertical movements. My answer to this is that I recognize the horizontal movements in mountain areas, but believe that these horizontal movements are incidental to the vertical movements which are involved in maintaining the isostatic balance and which also result from the changes in the temperature of crustal matter brought about by the maintenance of equilibrium. There is an abundance of space in a mountain area for horizontal movements to occur, and it seems to me that it is easier to explain these movements as resulting from upward or downward moving material than as resulting from a shrinking interior of the earth and a collapsing crust.

Isostasy is a geological problem. It was outlined by the great geologist, C. E. Dutton. It has been used by the geodesists merely as an effective means by which to harmonize theoretical and observed values of geodetic data. The geodesists hope that isostasy may prove of great value to geologists in their effort to write the geological history of the earth."

--W. Ayvazoglou.

(192) ISOSTASY FROM THE GEOLOGICAL POINT OF VIEW

By Rollin T. Chamberlin

The Journal of Geology, Chicago, Ill., vol. 39, No. 1, 1931, pp. 1-24.

Some of the outstanding geologic facts which have to be taken into account in a consideration of isostasy are enumerated. Mountain building, peneplanation, geosynclines, etc., are considered from the point of view of both geologic deductions and the isostasy theory. It is concluded that no single type of compensation or uniform depth of compensation meets the facts. The real test of the isostatic theory seems to lie in the limited regions of high relief. An attempt is made to show how geologic processes may operate to produce folded mountain ranges exhibiting the observed geologic phenomena and at the same time make it possible to satisfy the requirements of the geodetic determinations. Isostatic forces are in the whole equation of mountain-building forces, and play their appropriate part, but that part is secondary and subordinate.--Author's abstract.

9. NEW BOOKS

- (193) Handbuch der Geophysik (Handbook of Geophysics). Vol. III, No. 1, 570 pp. 207 illus. "Kräfte in der Erdkruste" (Forces in the earth's crust), by B. Gutenberg; "Plutonismus und Vulkanismus" (Plutonism and Vulcanism), by F. von Wolff; "Erdkrustenbewegungen" (Movements of the earth crust), by A. Born; "Geotechnische Hypothesen" (Geotechnical hypotheses), by B. Gutenberg; "Mechanische Wirkungen von Eis auf die Erdkruste" (mechanical effects of ice upon the earth crust), by H. Hess. Gebrüder Bornträger, Berlin, 1930. Subscription price, 48 marks.
- (194) Schlumberger, C. Etude sur la Prospection Électrique du Sous-sol (Study of the electrical prospecting of the subsoil). 2nd edition. Paris, Gauthier-Villars et C^{ie}, Editeurs. 1930. 96 pp., 61 figs. Contents: Chapter 1. Trials of electrical prospecting before 1912; (2) electrical conductivity of various rocks and minerals; (3) theoretical study of the method for drawing maps of equipotential lines; (4) method of operation for the establishment of a map of equipotential lines; (5) application of the map to the study of stratified terrain; (6) study of the form of a conducting mass; (7) distribution of the current in depth; (8) incited polarization; (9) spontaneous polarization. The work of electrical prospecting carried out in Sweden is briefly described in the annex.
- (195) Seidl, Erich. Bruch und Fließ-Formen der technischen Mechanik und ihre Anwendung auf Geologie und Bergbau. Band II, Scher Formen; Band III, Zerreiss Formen. (Break and flow forms of technical mechanics and their application to geology and mining. Vol. II, Shear forms; Vol III, Tear forms). V D I Verlag, Berlin, 1930, 22 pp. 51 text figs.; 81 pp. 145 textfigures. The following chapters are in preparation: I. Theoretical introduction; IV. Compression forms; V. Forms produced by bending; VI. Forms produced by flowage.
- (196) Shaw, Capt. H., with the assistance of J. McG. Bruckshaw and S. T. Newing. Applied Geophysics. A brief survey of the development of apparatus and methods employed in the investigation of subterranean structural conditions and the location of mineral deposits. Contents: Introduction; magnetic method; gravity methods; catalogue of exhibits: magnetic, gravity, seismic, electrical; index. Ten plates with illustrations. London, published by His Majesty's Stationery Office, 1931. Price, 2 s. net.
- (197) von Bernewitz, M. W. Handbook for Prospectors. McGraw-Hill Book Co., New York, 1931, 359 pp. Illus. \$3. 2nd edition. The reason for issuing a second edition instead of another printing was to enable the author to add a 40-page chapter on prospecting by geophysical methods.

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3 - The first figure refers to the number of the abstract, the second to the method of prospecting as indicated in the Table of Contents, and the third to the page.

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